

## WHAT IS CLAIMED IS:

- 1 1. A gas sensor for measuring the concentration of a specific gas component  
2 in a gas under measurement, comprising:  
3 a gas diffusion rate limiting portion limiting the rate of diffusion of the  
4 gas under measurement;  
5 a measurement chamber communicating with an atmosphere of the gas  
6 under measurement through the gas diffusion rate limiting portion;  
7 a sensor element having an ion-conductive layer with first and second  
8 surfaces, a first electrode disposed in contact with the first surface of the  
9 ion-conductive layer within the measurement chamber, and a second electrode  
10 disposed in contact with the second surface of the ion-conductive layer and  
11 communicating exclusively with the atmosphere of the gas under measurement;  
12 a cylindrical support member installing therein the sensor element with  
13 the first and second surfaces of the ion-conductive layer directed toward front and  
14 base end sides of the support member, respectively; and  
15 a circuit for applying a voltage between the first and second electrodes to  
16 cause dissociation, decomposition or reaction of the specific gas component of the  
17 gas in the measurement chamber and thereby generates ions at the first electrode,  
18 allowing an electric current flow due to migration of the ions from the first  
19 electrode to the second electrode through the ion-conductive layer, and  
20 determining the concentration of the specific component in the gas under  
21 measurement based on the electric current flow.
- 1 2. A gas sensor according to Claim 1, further comprising:  
2 a gas introduction passage for introducing the gas from the atmosphere of  
3 the gas under measurement to the first electrode; and  
4 a gas return passage for returning the gas drawn to the second electrode  
5 to the atmosphere of the gas under measurement.
- 1 3. A gas sensor according to Claim 2, wherein the gas introduction passage

2 leads to the measurement chamber from the front end side of the support member.

1 4. A gas sensor according to Claim 2, wherein the gas return passage  
2 extends to the front end side of the support member.

1 5. A gas sensor according to Claim 1, wherein the gas diffusion rate limiting  
2 portion is formed in the support member.

1 6. A gas sensor according to Claim 1, further comprising a filter having  
2 water repellency and air permeability and arranged between the gas diffusion rate  
3 limiting portion and the atmosphere of the gas under measurement.

1 7. A gas sensor according to Claim 1, wherein the ion-conductive layer is a  
2 proton-conductive layer so that the gas sensor measures the concentration of  
3 hydrogen in the gas under measurement.

1 8. A gas sensor according to Claim 1, wherein the gas sensor is designed to  
2 be fixed to a pipe through which the gas under measurement flows.

1 9. A gas sensor for measuring the concentration of a specific gas component  
2 in a gas under measurement, comprising:  
3 a gas diffusion rate limiting portion limiting the rate of diffusion of the  
4 gas under measurement;  
5 a measurement chamber communicating with an atmosphere of the gas  
6 under measurement through the gas diffusion limiting portion;  
7 a sensor element provided with an ion-conductive layer having first and  
8 second surfaces directed to front and base ends of the gas sensor, respectively, a  
9 first electrode disposed in contact with the first surface of the ion-conductive layer  
10 within the measurement chamber, and a second electrode disposed in contact with  
11 the second surface of the ion-conductive layer and communicating exclusively  
12 with the atmosphere of the gas under measurement:

13           first and second support members located on front and base end sides of  
14 the sensor element, respectively, to support the sensor element between the first  
15 and second support members; and  
16           a circuit for applying a voltage between the first and second electrodes to  
17 cause dissociation, decomposition or reaction of the specific component of the gas  
18 in the measurement chamber and thereby generate ions at the first electrode,  
19 allowing an electric current flow due to migration of the ions from the first  
20 electrode to the second electrode through the ion-conductive layer, and  
21 determining the concentration of the specific component in the gas under  
22 measurement based on the electric current flow.

1    10.     A gas sensor according to Claim 9, further comprising:  
2           a gas introduction passage for introducing the gas from the atmosphere of  
3 the gas under measurement to the first electrode; and  
4           a gas return passage for returning the gas drawn to the second electrode  
5 to the atmosphere of the gas under measurement.

1    11.     A gas sensor according to Claim 10, wherein the gas introduction passage  
2 has a gas introduction hole formed in the first support member such that the gas  
3 introduction passage leads to the measurement chamber from a front end side of  
4 the first support member.

1    12.     A gas sensor according to Claim 10, the gas return passage including:  
2           a first gas return channel extending laterally outwardly in the second  
3 support member; and  
4           a second gas return channel connected with the first gas return channel  
5 and extending to a front end side of the first support member.

1    13.     A gas sensor according to Claim 9, wherein the gas diffusion rate limiting  
2 portion is formed in the first support member.

1 14. A gas sensor according Claim 9, wherein the first support member is  
2 formed into a cylindrical shape and installs therein the sensor element and  
3 optionally the second support member.

1 15. A gas sensor according to Claim 9, wherein the first support member is  
2 mainly made of a ceramic material.

1 16. A gas sensor according to Claim 15, wherein the first support member  
2 has an electrically conductive portion connected to the first electrode.

1 17. A gas sensor according to Claim 9, the second support member having:  
2 at least two ceramic layers laminated to each other;  
3 a front end electrode arranged at a front end side of the second support  
4 member;  
5 a base end electrode arranged at a base end side of the second support  
6 member;  
7 at least one electrically conductive layer, each of which is arranged  
8 between adjacent two of the ceramic layers; and  
9 through holes formed in the respective ceramic layers so as to allow  
10 offset therebetween and to provide electrical connection between the front and  
11 base end electrodes through said at least electrically conductive layer.

1 18. A gas sensor according to Claim 9, further comprising an elastic member  
2 pushing the second support member and the sensor element to the first support  
3 member.

1 19. A gas sensor according to Claim 9, further comprising a filter having  
2 water repellency and air permeability and arranged between the gas diffusion rate  
3 limiting portion and the atmosphere of the gas under measurement.

1 20. A gas sensor according to Claim 9, wherein the ion-conductive layer is a

2 proton-conductive layer so that the gas sensor measures the concentration of  
3 hydrogen in the gas under measurement.

1 21. A gas sensor according to Claim 9, wherein the gas sensor is designed to  
2 be fixed to a pipe through which the gas under measurement flows.

1 22. A gas sensor for measuring the concentration of a specific gas component  
2 in a gas under measurement, comprising:  
3 a gas diffusion rate limiting portion limiting the rate of diffusion of the  
4 gas under measurement;  
5 a measurement chamber communicating with an atmosphere of the gas  
6 under measurement through the gas diffusion limiting portion;  
7 a sensor element having an ion-conductive layer with first and second  
8 surfaces, a first electrode disposed in contact with the first surface of the  
9 ion-conductive layer within the measurement chamber, and a second electrode  
10 disposed in contact with the second surface of the ion-conductive layer and  
11 communicating exclusively with the atmosphere of the gas under measurement:  
12 means for supporting the sensor element in such a manner the first and  
13 second surface of the ion-conductive layer are directed toward front and base ends  
14 of the gas sensor, respectively; and  
15 a circuit for applying a voltage between the first and second electrodes to  
16 cause dissociation, decomposition or reaction of the specific component of the gas  
17 in the measurement chamber and thereby generate ions at the first electrode,  
18 allowing an electric current flow due to migration of the ions from the first  
19 electrode to the second electrode through the ion-conductive layer, and  
20 determining the concentration of the specific component in the gas under  
21 measurement based on the electric current flow.

1 23. A gas sensor according to Claim 22, wherein the gas sensor is designed to  
2 be fixed to a pipe through which the gas under measurement flows.